Calibration Status of the Atmospheric Infrared Sounder (AIRS) on Aqua

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AGENDA
AIRS Calibration Status

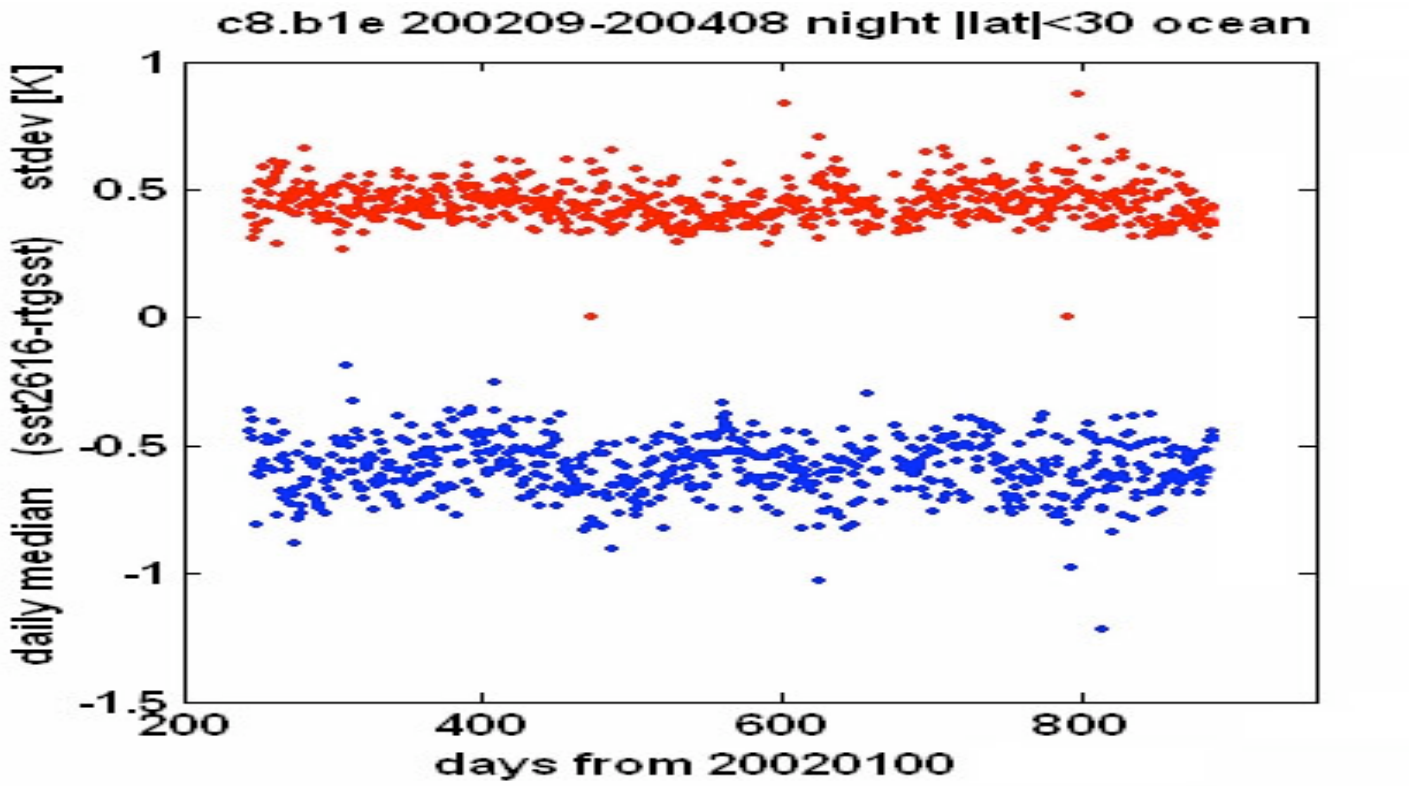
- **Instrument Calibration Stability**
- **V3/V4 Algorithm Differences**
- **Proposed V4/V5 Changes**

Radiometric Status
AIRS Calibration Status

- **Radiometric biases consistent with pre-launch determination, no more than several tenths of a degree**
- **Small radiometric biases observed by Aumann, Strow, Tobin, et. al. not convincingly due to AIRS**
- **Radiometric stability remains excellent, as shown by Aumann**
- **For all uses except climate, AIRS radiometric accuracy and stability seem not to be limiting factors**

Radiometric Stability
AIRS Calibration Status

- **Aumann analysis of water-corrected channel 2333 (2616 cm-1) vs. RGT-SST shows excellent stability**

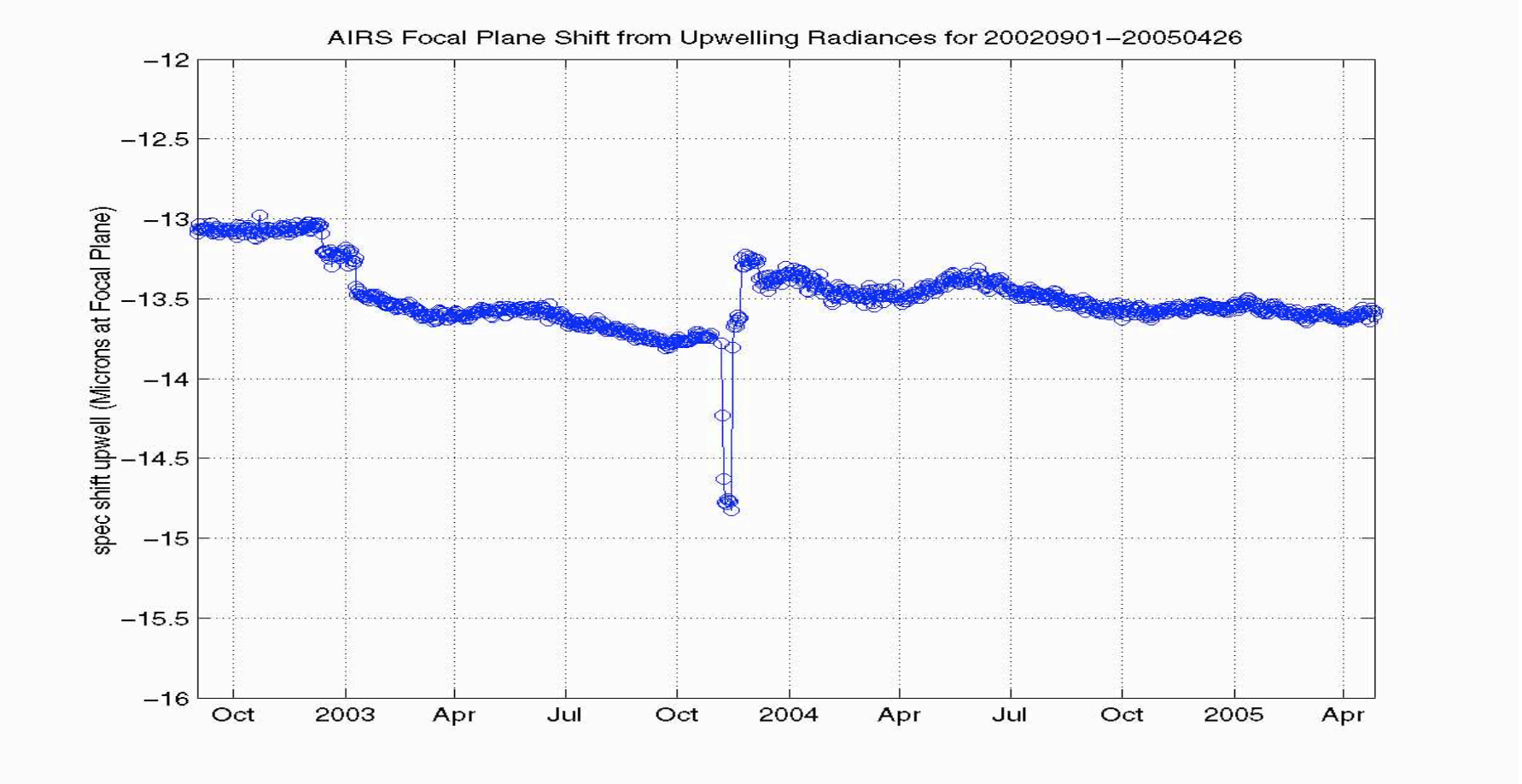


Spectral Status
AIRS Calibration Status

- **Spectral stability continues to exceed requirement of 1% FWHM for all time scales**
- **Frequency variations smaller than this have been observed independently by Gaiser, Strow, and Aumann**
- **Frequencies vary orbitally, annually, and over a longer time scale, for reasons not fully understood**
- **The effect is below the noise level of individual measurements at all frequencies**
- **Needs to be accounted for when looking for variations in large-number statistics, at the edges of spectral lines**

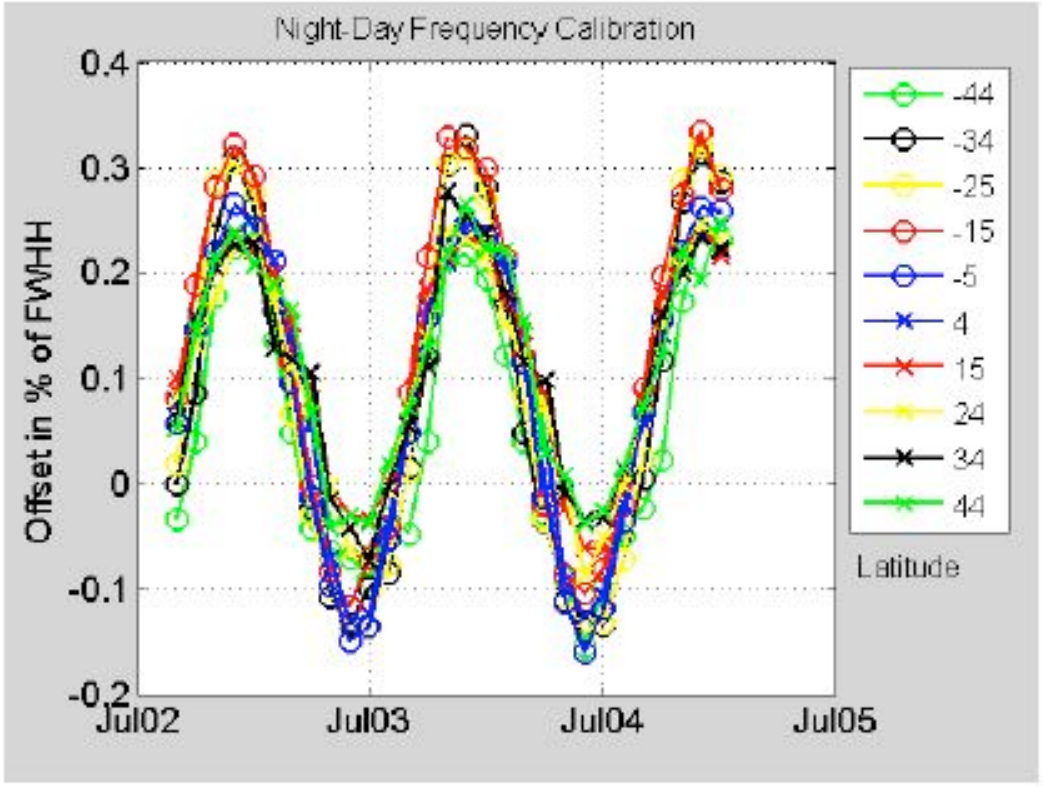
Spectral Stability
AIRS Calibration Status

- **PGE spectral shifts, daily medians**



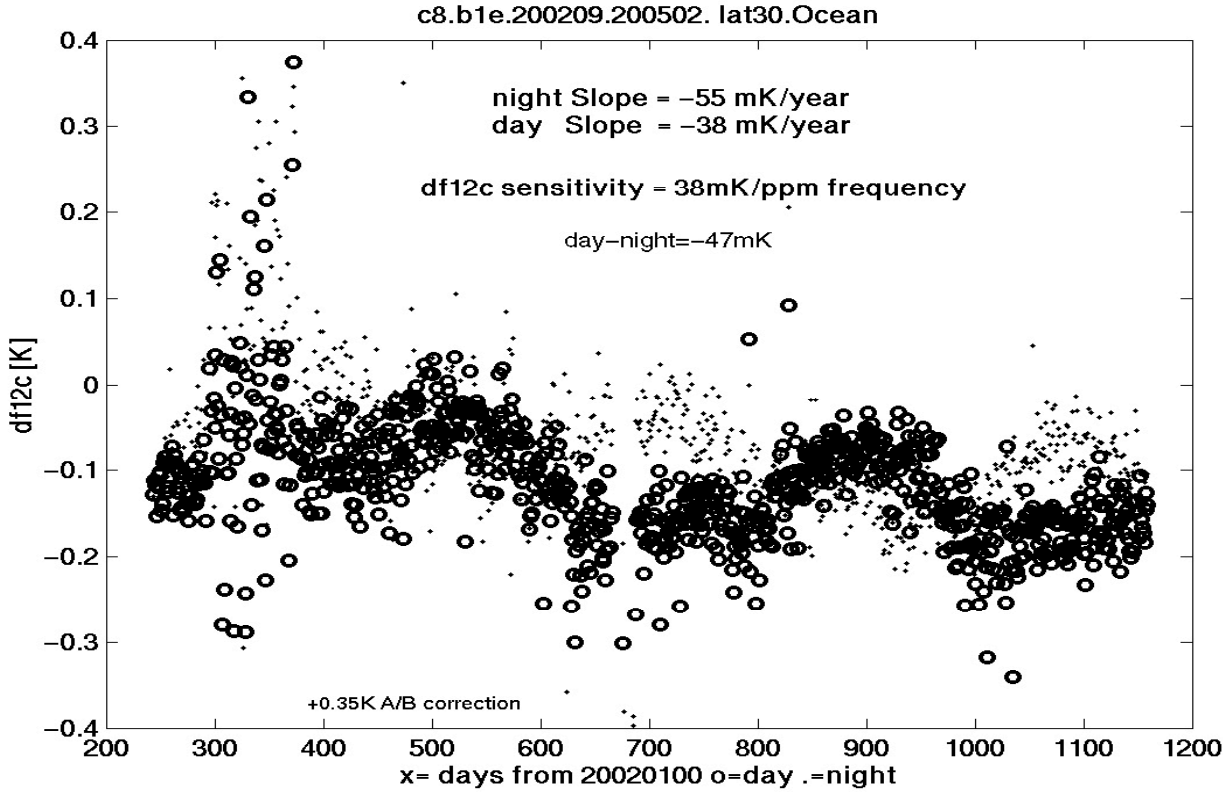
Spectral Stability
AIRS Calibration Status

- **Orbital frequency variation, as determined by UMBC**
- **0.4% FWHM peak-to-peak**



Spectral Stability
AIRS Calibration Status

- **Long-term spectral stability, as determined by Aumann using a single pair of channels**



V3/V4 Algorithm Differences
AIRS Calibration Status

- **Radiance rounding**
  - ***Changes by a fraction of NeN***
  - ***No biases introduced***
- **Offset smoothing**
  - ***Better offset calculation***
  - ***Reduced striping***
  - ***Improved noise estimates***
- **Gain filtering**
  - ***Noticable impact only for problem granules***

V4/V5 Proposed Algorithm Changes
AIRS Calibration Status

- **Spectral Calibration Update**
  - ***Trying to improve per-granule calculations***
  - ***"Post-mortem" analysis results available as a backup***
- **Detector Characterization**
  - ***Take less conservative approach***
  - ***Separate actual detector properties from L2 information***
  - ***Remove judgement calls, retain quantitative information***

Detector Characterization
AIRS Calibration Status

- **Motivation:**
  - ***Don't know users' needs; there is (and can be) no "one size fits all" prescription***
  - ***Many useful channels are being overlooked, resulting in channel availability being maligned***
- **Problem fields**
  - ***Radiometric Quality: 0-4***
  - ***AB_State: Currently 0-6, with 0-2 good, 3-5 not good, and 6 bad***
  - ***L2_ignore: Clearly application specific; being misused***
  - ***RTA Fitting Error: specific to users of our forward algorithm***
- **Proposal:**
  - ***Separate detector properties from L2 properties***
  - ***Replace ABState with instrument AB weight (0-2)***
  - ***Let user make their own choices based on quantitative indicators***

SUMMARY
AIRS Calibration Status

- **AIRS is GREAT!**
- **There's no indication that improving AIRS calibration could improve weather forecasting**
- **While minor maintenance activities continue, the calibration activity now is primarily an effort to understand very small instrument effects, to distinguish them from climate signals**

BACKUP SLIDES
AIRS Calibration Status

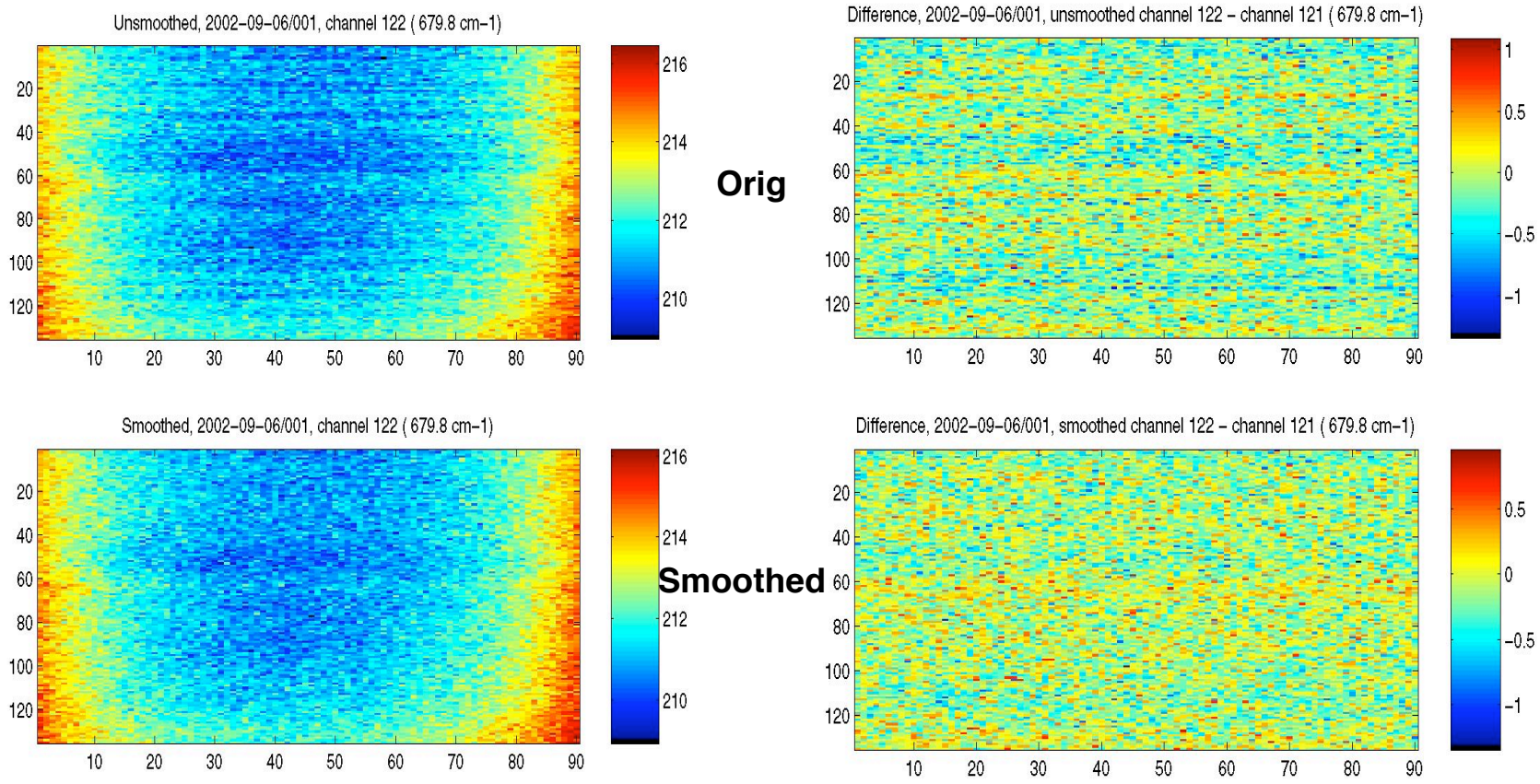
Offset Smoothing
AIRS Calibration Status

- Implemented to reduce “striping” (artificial correlations within a scanline)
- Previous algorithm calculated offset for each channel once per scan as the median of 8 space views
- New algorithm calculates offset by linear fit in time across 10 scan lines
- Changes (corrects) scan angle-dependent biases by up to 10 mK in some channels
- Slightly improves noise estimates

Offset smoothing example
AIRS Calibration Status

Ch 122 image

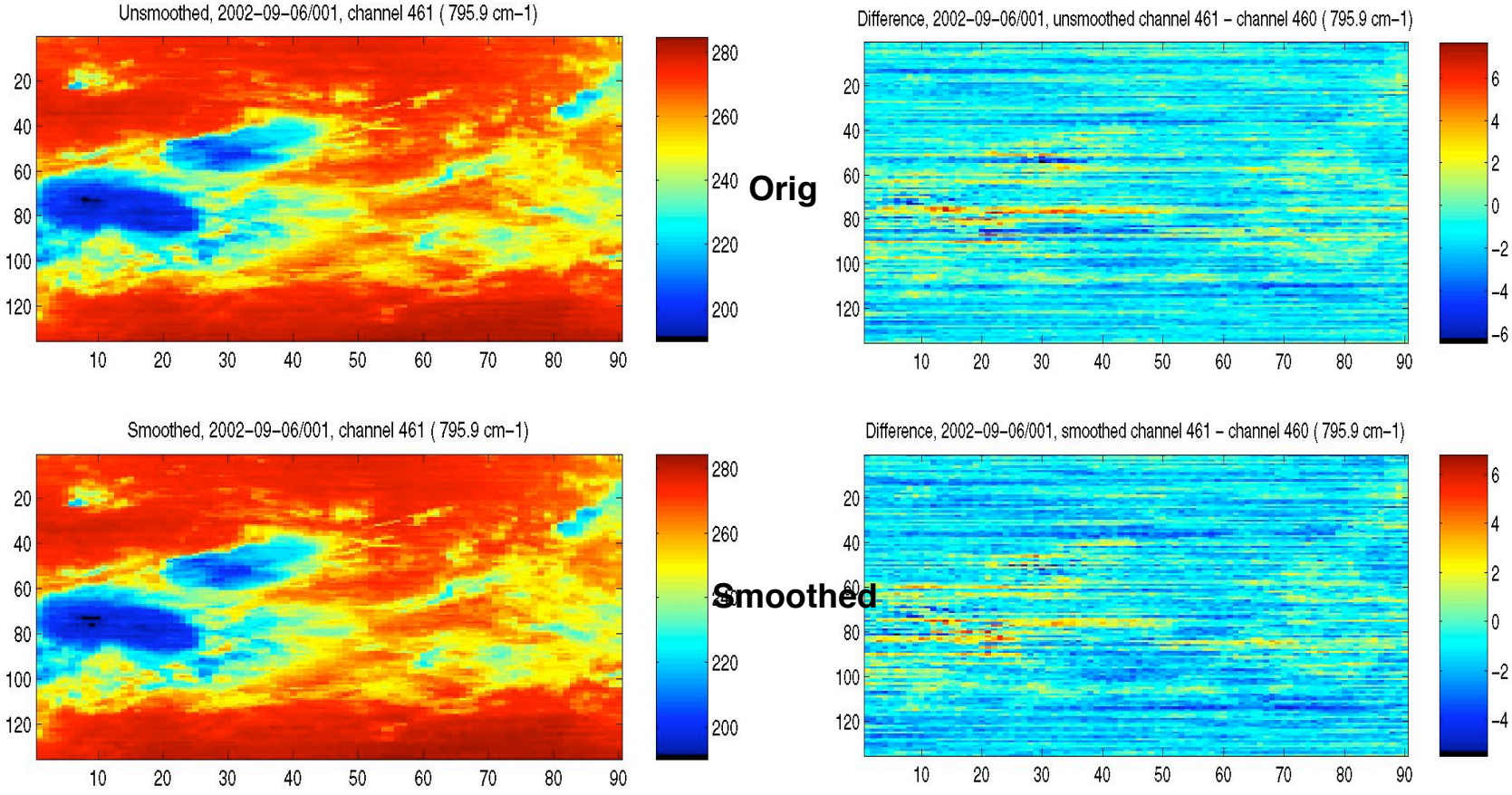
Ch 122 - ch 121



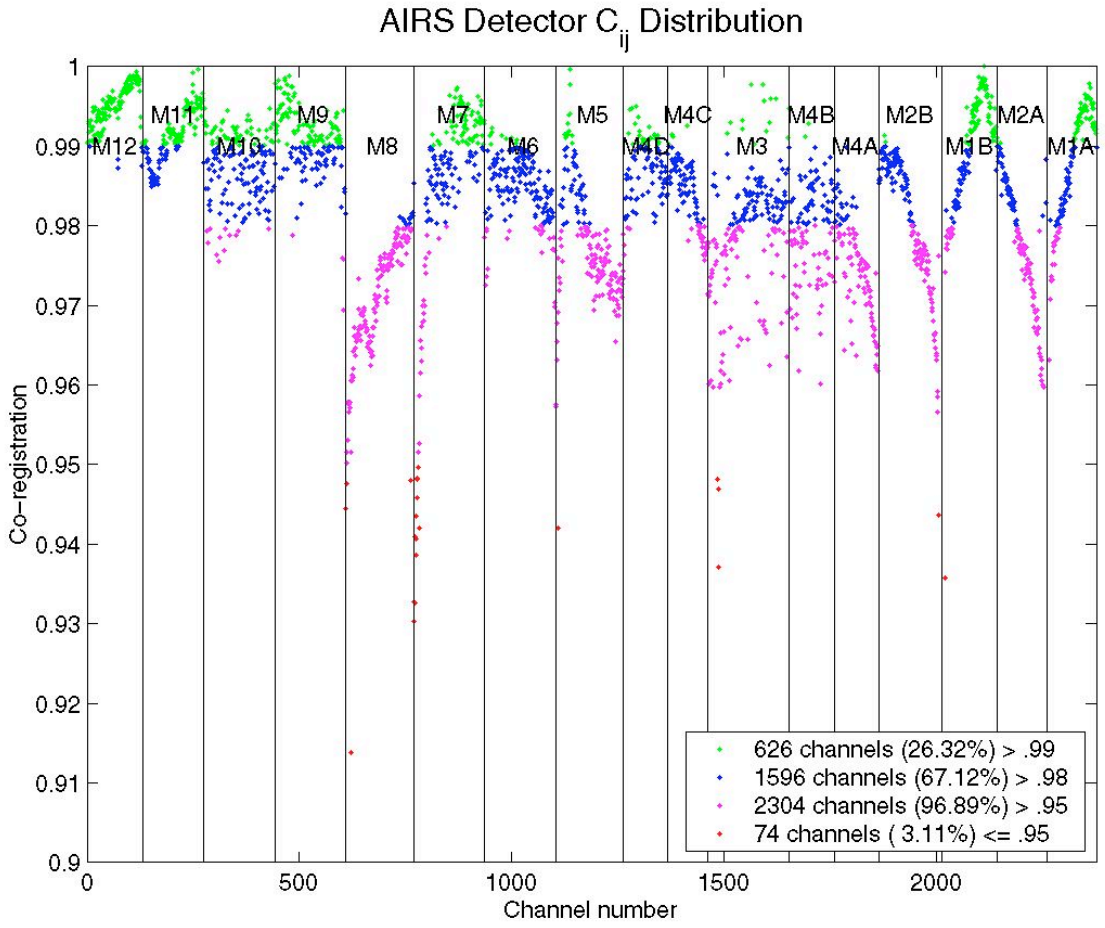
Offset smoothing example
AIRS Calibration Status

Ch 461 image

Ch 461 - ch 461



Cij Distribution
AIRS Calibration Status



Centroid Distribution
AIRS Calibration Status